What is claimed is:

1. In an optical detector for sensing the strength of an external optical wave comprising:

a multiplicity of electrodes spaced in a substantially regular pattern, the multiplicity of electrodes adapted to resonantly couple between the external optical wave and a local optical wave and to allow a potential difference between adjacent electrodes, wherein the multiplicity of electrodes comprise a metal;

a structure associated with the multiplicity of electrodes, wherein the structure and the multiplicity of electrodes support the local wave; and

a sensor connected to the multiplicity of electrodes for sensing an electrical quantity,

the improvement comprising:

a substrate comprising a semiconductor in superposed relationship with the electrodes; and

an aspect ratio of at least 1 of a height of the multiplicity of electrodes to a spacing between adjacent electrodes;

wherein the local wave comprises a surface plasmon wave having a component of momentum oriented substantially perpendicular to a detector surface.

2. The optical detector of Claim 1, wherein the spacing is at least about 20 nanometers.

3. The optical detector of Claim 1, wherein the aspect ratio is at least 3.

4. The optical detector of Claim 1, wherein the aspect ratio is substantially in a range greater than about 4 and less than about 16.

5. The optical detector of Claim 1, wherein the aspect ratio is substantially in a range greater than about 10 and less than about 15.

6. The optical detector of Claim 1, wherein the substrate comprises one of mercury cadmium telluride, indium gallium arsenide, and silicon.

7. The optical detector of Claim 1, wherein the substrate comprises a silicon-on-insulator structures.

8. The optical detector of Claim 1, further comprising:

a second multiplicity of electrodes spaced in a substantially regular pattern rotated 90° in the plane of the detector surface, the second multiplicity of electrodes being in superposed relationship with the multiplicity of electrodes and the substrate, wherein the second multiplicity of electrodes are adapted to resonantly couple between the external optical wave and the surface plasmon wave, the surface plasmon wave having a component of momentum oriented substantially perpendicular to the detector surface.

9. The optical detector of Claim 1, further comprising a semiconductor layer substantially filling the spacing between adjacent electrodes.

10. The optical detector of Claim 1, wherein the height of the multiplicity of electrodes is at least about 50 nanometers.

11. The optical detector of Claim 1, wherein the height of the multiplicity of electrodes is substantially in a range of about 50 nanometers to about 1500 nanometers.

12. The optical detector of Claim 1, wherein the height of the multiplicity of electrodes is substantially in a range of about 100 nanometers to about 750 nanometers.

13. An optical device for sensing the strength of an incident optical wave within a wavelength range, comprising:

a first array of first electrodes, the first array comprising a first contact window having a first width, a first contact window dielectric having a first dielectric constant, a first contact thickness and a first contact width;

a second array of second electrodes, the second array comprising a second contact window having a second width, a second contact window dielectric having a second dielectric constant, a second contact thickness and a second contact width, wherein the second array is linearly displaced relative to the first array, the second electrodes being interdigitated with the first electrodes, the device further comprising a pitch;

a structure associated with the first array and the second array for resonantly coupling between the incident optical wave and a local electromagnetic resonance, the electromagnetic resonance comprising at least a cavity mode of a local surface plasmon wave;

a substrate, the structure comprising the first array and the second array being in superposed relationship with the substrate; and

a sensor connected to the first electrodes and the second electrodes for sensing an electrical quantity.

14. The optical device of Claim 13, wherein the substrate comprises one of an elemental IV semiconductor, a III-V semiconductor, and a II-VI semiconductor.

15. The optical device of Claim 14, wherein the substrate comprises one of mercury cadmium telluride, indium gallium arsenide, and silicon.

16. The optical device of Claim 15, wherein the substrate comprises mercury cadmium telluride, wherein the first electrodes and the second electrodes comprise aluminum, wherein the first dielectric constant is in a range of from 1.75 to 4.0, and wherein the first dielectric constant is greater than the second dielectric constant.

17. The optical device of Claim 16, the structure resonantly coupling with a hybrid mode, the hybrid mode comprising at least the cavity mode and a horizontal surface plasmon mode, wherein the wavelength range comprises a range from at least about 2.0 micrometers to about 4.0 micrometers.

18. The optical device of Claim 16, the structure resonantly coupling with a hybrid mode, wherein the wavelength range comprises a range from at least 4.0 micrometers to about 15 micrometers, wherein each of the first and the second width is in a range from .5 micrometers to .9 micrometers, wherein each of the first contact thickness and the second contact thickness is in a range of from .45 micrometers to .85 micrometers, and wherein each of the first contact width and the second contact width is in a range of from .2 micrometers to .5 micrometers.

19. The optical device of Claim 14, wherein the substrate comprises silicon, the structure resonantly coupling with a hybrid mode, the hybrid mode comprising at least the cavity mode and a horizontal surface plasmon mode, the wavelength range comprising a range from about 830 nanometers to at least about 850 nanometers, further wherein each of the first contact width and the second contact width is greater than each of the first width and the second width.

20. The optical device of Claim 19, wherein the first electrodes and the second electrodes comprise gold, wherein the first dielectric constant is in a range from 1.75 to 4.0, and wherein the first dielectric constant is greater than the second dielectric constant.

21. The optical device of Claim 20, wherein each of the first contact thickness and the second contact thickness is within a range of from .075 to .2 micrometers.

22. The optical device of Claim 20, wherein each of the first and the second width is within a range of .075 micrometers to .25 micrometers.

23. The optical device of Claim 14, wherein the substrate comprises a silicon-on-insulator structure.

24. The optical device of Claim 14, wherein the substrate comprises silicon, wherein the second dielectric constant is greater than the first dielectric constant, and wherein each of the first contact width and the second contact width is greater than the first width and the second width.

25. The optical device of Claim 24, wherein the first electrode and the second electrode comprise a metal, and wherein at least one of the first contact thickness and the second contact thickness is at least 100 nm.

26. The optical device of Claim 24, wherein the second dielectric constant is in a range of from 1.75 to 4.0.

27. The optical device of Claim 25, wherein the first contact width is at least twice the first width, and wherein the first contact width is within a range from about .2 micrometers to about .4 micrometers.

28. The optical device of Claim 23, comprising at least .25 A/W responsivity and a bandwidth of at least 30 GHz, within an operating wavelength range of 830 nm to 850 nm.

29. The optical device of Claim 23, wherein the second dielectric constant is greater than the first dielectric constant, wherein the first contact width is greater than the first width.

30. The optical device of Claim 23, wherein the second dielectric is silicon oxide, wherein the first contact width is at least twice the first width, and wherein each of the first thickness and the second thickness is at least 100 nm.

31. The optical device of Claim 30, the substrate comprising a top silicon layer and an insulator layer, wherein the top silicon layer is within a range from about 300 nanometers to about 400 nm, and wherein the insulator layer is within a range from about 25 nm to about 75 nm.